

CLAIMS

1. An air heater system for a vehicle, the system comprising:
an air heater having an electrothermal heating element; and
a semiconductor switch connected to the electrothermal heating
5 element in series for controlling energization to the electrothermal heating
element,

the semiconductor switch being a semiconductor switch having a
current detecting function provided with a terminal for current detection to
detect a current which flows in the electrothermal heating element.

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2. The air heater system for a vehicle according to claim 1, further
comprising resistance control means for controlling a resistance value of
the electrothermal heating element based on output corresponding to the
current which flows in the electrothermal heating element detected
15 through the current detection terminal of the semiconductor switch.

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3. The air heater system for a vehicle according to claim 1 or 2,
further comprising failure detection means for detecting a failure of the
electrothermal heating element by detecting a resistance value of the
electrothermal heating element based on output corresponding to the
20 current which flows in the electrothermal heating element detected
through the current detection terminal of the semiconductor switch.

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4. The air heater system for a vehicle according to any one of claims
1 to 3, wherein

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the air heater includes a frame which holds the electrothermal
heating element, and

the semiconductor switch is fixed to the frame.

5. The air heater system for a vehicle according to claim 4, wherein
the electrothermal heating element has such a temperature
converging property that a temperature rises and then converges to a
predetermined convergence temperature when the electrothermal heating
5 element is continuously supplied with maximum allowable voltage,
the frame includes a resinous part made of resin, and
the resinous part is arranged in such a place that the resinous part
has rigidity adequate for actual use even when the electrothermal heating
10 element is at the convergence temperature.

6. The air heater system for a vehicle according to claim 4, wherein
the electrothermal heating element has such a temperature
converging property that a temperature rises and then converges to a
predetermined convergence temperature when the electrothermal heating
15 element is continuously supplied with maximum allowable voltage,
the frame includes a resinous part made of resin having a
predetermined deflection temperature under load, and
the resinous part is arranged in such a place that the temperature of
20 the resinous part remains below the deflection temperature under load
even when the electrothermal heating element is at the convergence
temperature.

7. An air heater system for a vehicle comprising:
25 an air heater having an electrothermal heating element; and
a semiconductor switch connected to the electrothermal heating
element in series for controlling energization to the electrothermal heating
element,

the air heater having a frame which holds the electrothermal heating element, and

the semiconductor switch being fixed to the frame.

5 8. The air heater system for a vehicle according to claim 7, wherein
the semiconductor switch has an overtemperature protecting function
for interrupting current passing through the semiconductor switch when a
temperature thereof becomes a shut-off temperature, and

10 the semiconductor switch is fixed to the frame in such a place that the
temperature of the semiconductor switch becomes the shut-off temperature
when the temperature of the electrothermal heating element reaches an
excessive temperature.

15 9. The air heater system for a vehicle according to claim 8, wherein
the frame of the air heater includes a metallic part, and
the semiconductor switch is fixed to the metallic part of the frame
directly or through an electrical insulator.

20 10. The air heater system for a vehicle according to claim 7, wherein
the semiconductor switch includes an overtemperature signal output
terminal which outputs an overtemperature warning signal when the
temperature of the semiconductor switch becomes a warning temperature,
the semiconductor switch is fixed to the frame in such a place that the
temperature of the semiconductor switch becomes the warning
25 temperature when the temperature of the electrothermal heating element
reaches the excessive temperature, and

the air heater system includes overtemperature protecting means for
interrupting the current passing through the semiconductor switch in

response to the overtemperature warning signal from the overtemperature signal outputting terminal of the semiconductor switch.

11. The air heater system for a vehicle according to claim 10,
5 wherein the frame of the air heater includes a metallic part, and
the semiconductor switch is fixed to the metallic part of the frame directly or through an electrical insulator.

12. The air heater system for a vehicle according to claim 7, wherein
10 the electrothermal heating element has such a temperature converging property that a temperature rises and then converges to a predetermined convergence temperature when the electrothermal heating element is continuously supplied with maximum allowable voltage,
the frame includes a resinous part made of resin, and
15 the resinous part is arranged in such a place that the resinous part has rigidity adequate for actual use even when the electrothermal heating element is at the convergence temperature.

13. The air heater system for a vehicle according to claim 7, wherein
20 the electrothermal heating element has such a temperature converging property that a temperature rises and then converges to a predetermined convergence temperature when the electrothermal heating element is continuously supplied with maximum allowable voltage,
the frame includes a resinous part made of resin having a
25 predetermined deflection temperature under load, and
the resinous part is arranged in such a place that the temperature of the resinous part remains below the deflection temperature under load even when the electrothermal heating element is at the convergence

temperature.

14. An air heater unit for a vehicle, the unit comprising:

an air heater includes an electrothermal heating element and a frame
5 which holds the electrothermal heating element, and

a semiconductor switch fixed to the frame of the air heater and
connected to the electrothermal heating element in series to control
energization to the electrothermal heating element.

10 15. The air heater unit for a vehicle according to claim 14, wherein
the semiconductor switch has an overtemperature protecting function
for interrupting current passing through the semiconductor switch when a
temperature thereof becomes a shut-off temperature, and

15 the semiconductor switch is fixed to the frame in such a place that the
temperature of the semiconductor switch becomes the shut-off temperature
when the temperature of the electrothermal heating element reaches an
excessive temperature.

16. The air heater unit for a vehicle according to claim 15, wherein
20 the frame of the air heater includes a metallic part, and
the semiconductor switch is fixed to the metallic part of the frame
directly or through an electrical insulator.

17. The air heater unit for a vehicle according to claim 14, wherein
25 the semiconductor switch includes an overtemperature signal output
terminal which outputs an overtemperature warning signal when the
temperature of the semiconductor switch becomes a warning temperature,
and

the semiconductor switch is fixed to the frame in such a place that the temperature of the semiconductor switch becomes the warning temperature when the temperature of the electrothermal heating element reaches the excessive temperature.

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18. The air heater unit for a vehicle according to claim 17, wherein wherein the frame of the air heater includes a metallic part, and

the semiconductor switch is fixed to the metallic part of the frame directly or through an electrical insulator.

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19. The air heater unit for a vehicle according to claim 14, wherein the electrothermal heating element has such a temperature converging property that a temperature rises and then converges to a predetermined convergence temperature when the electrothermal heating element is continuously supplied with maximum allowable voltage,

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the frame includes a resinous part made of resin, and

the resinous part is arranged in such a place that the resinous part has rigidity adequate for actual use even when the electrothermal heating element is at the convergence temperature.

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20. The air heater unit for a vehicle according to claim 14, wherein the electrothermal heating element has such a temperature converging property that a temperature rises and then converges to a predetermined convergence temperature when the electrothermal heating element is continuously supplied with maximum allowable voltage,

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the frame includes a resinous part made of resin having a predetermined deflection temperature under load, and

the resinous part is arranged in such a place that the temperature of

the resinous part remains below the deflection temperature under load even when the electrothermal heating element is at the convergence temperature.